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ECONOMIC AND ENVIRONMENTAL QUESTIONS: ENERGY

Energy exploration and development trends in developing countries

Report of the Secretary-General

SUMMARY

In its resolution 1992/56 of 31 July 1992, the Economic and Social Council reaffirmed the critical importance of the development of energy resources of developing countries and the need for measures by the international community to assist and support the efforts of developing countries, in particular the energy-deficient among them, to develop their energy resources in order to meet their needs through cooperation, assistance and investment in the fields of conventional and of new and renewable sources of energy, consistent with their national policies, plans and priorities.

In the same resolution, the Economic and Social Council also reaffirmed that the developing countries had the primary responsibility for the strategies and policies for exploration and development of their energy resources and that an adequate flow of external resources in support of the national efforts of developing countries, in particular the energy deficient among them, was needed to finance, within the legislative framework of each country, the exploration and development of their energy resources.

* E/1994/100.

Also in the same resolution, the Economic and Social Council took note with appreciation of the report of the Secretary-General on energy exploration and development trends in developing countries (A/47/202-E/1992/51) and requested the Secretary-General to keep the matter under review and to submit to the Economic and Social Council at its substantive session of 1994 a report on the efforts made in that regard.

In the same resolution, the Council further requested the Secretary-General to draw the matter to the attention of the Committee on New and Renewable Sources of Energy and on Energy for Development at its first substantive session.

The present report updates previous analyses of trends in energy consumption and production in the developing countries and focuses on problems and issues over the next 10 to 20 years in the light of evolving political and environmental policies and technological changes.

The Economic and Social Council will also have before it the report of the Committee on New and Renewable Sources of Energy and on Energy for Development on its first session (E/1994/25). Accordingly, the present report should be considered in conjunction with the reports of the Secretariat submitted to that Committee, namely: "Changing global energy patterns" (E/C.13/1994/2); "Update on new and renewable sources of energy" (E/C.13/1994/3); "Energy programme activities within and outside the United Nations system" (E/C.13/1994/4); "Means to promote and implement energy efficiency in developing countries" (E/C.13/1994/5); and "Issues in the transfer of clean coal technologies to developing countries" (E/C.13/1994/6).

CONTENTS

		Paragraphs	Page
INTRODUCTION		1 - 9	5
I.	TRENDS IN ENERGY CONSUMPTION	10 - 19	6
II.	TRENDS IN ENERGY EXPLORATION, DEVELOPMENT AND PRODUCTION	20 - 82	10
	A. Advances in energy technologies	20 - 34	10
	B. Crude oil	35 - 56	13
	C. Natural gas	57 - 68	22
	D. Coal	69 - 74	25
	E. Electric power	75 - 82	29
III.	INVESTMENT TRENDS AND FINANCIAL REQUIREMENTS	83 - 91	32
IV.	CONCLUSIONS AND PROPOSALS FOR ACTION	92 - 94	38

Tables

1.	Outlook for OPEC sustainable crude oil production capacity	17
2.	Exploration and development indicators of OPEC member countries, 1983-1992	18
3.	Exploration and development indicators of non-OPEC oil exporting developing countries, 1983-1992	19
4.	Exploration and development indicators in oil producing/importing developing countries, 1983-1992	21
5.	Exploration and development indicators in non-oil producing developing countries, 1983-1992	21
6.	Volume of energy loans by nationality of borrower, 1992 and 1993	33
7.	Capital expenditures on petroleum by majority-owned affiliates of United States companies	35

CONTENTS (continued)

Page

Figures

I. Global shares of primary energy sources and the major purposes for which they were used, 1991 8

II. Commercial energy consumption and GDP, 1991 9

III. Crude oil monthly average prices 11

IV. World oil production by region, 1992-1993 14

V. Petroleum production by group of countries, 1970-1993 15

VI. Remaining reserves of natural gas at end-1992 23

VII. Natural gas consumption by region, 1975-1992 24

VIII. Proved coal reserves at end-1992 27

IX. Coal production and consumption by area, 1982 versus 1992 28

X. Hydroelectricity generation by region, 1960-1991 30

XI. Nuclear share of electricity generation 31

XII. Capital expenditures on petroleum by majority-owned affiliates of United States companies, 1982-1993 34

INTRODUCTION

1. During the past few years, international energy markets have received limited attention because of ample supplies, a marked slow-down in the growth rates of energy consumption in several developed countries caused by recession, and improving energy efficiencies and lower energy prices, particularly of crude oil.

2. Changes in the structures of energy industries have accelerated as a result of privatization, downscaling and the application of modern technologies in all aspects of the exploration, development, production, transportation, transformation and utilization of energy. Many new technologies have led to a considerable reduction in real costs. However, higher investments for environmental reasons have had the opposite effect. At the same time, energy taxes, especially on oil products, have led to higher prices for consumers.

3. Foreign direct investments in the energy sector have increased both in absolute terms and relative to sources, which now include transnational corporations that are not only involved in oil but also increasingly involved in natural gas and electricity and to a more limited extent in new and renewable sources of energy (NRSE). The number of such corporations has increased and they now represent more home countries from the developed market economies and the developing world. The process has been assisted by the lack of energy investment opportunities in the developed world because of either limited energy exploration potential or a slow rate of growth in energy consumption, as well as by the opening up to investment of a large number of developing countries and economies in transition on increasingly favourable and competitive terms. A number of developing countries that had previously nationalized foreign energy concessions have participated in the process.

4. But despite that state of relative tranquillity, recent energy developments are causing a variety of concerns that will require constant monitoring by the international community. As indicated in the report of the Secretary-General on changing global energy patterns, in many developing countries - even energy exporting ones - shortages of fossil fuels and/or electricity often cause severe losses of economic output. The number of the energy poor is growing, particularly in rural areas. Yet economic growth and the consequent increase in energy consumption are imperative for meeting the needs of a growing population and tackling serious local as well as global environmental problems. While national efforts to alleviate those problems are essential, their solution will require expanded international cooperation and special measures (E/C.13/1994/2, para. 96).

5. Despite disappointing economic growth rates in the developing world during the past two decades, energy consumption has increased at an annual rate of 6.6 per cent, or six times as high as the growth rate of the developed market economies. In recent years, the newly industrializing economies of Asia and the Pacific have registered even higher rates of increase in energy consumption. By the year 2020, the share of the developing countries in the consumption of world fossil fuels, which is currently estimated at 26 per cent, may reach 48 per cent. High energy intensities are expected to continue in the developing

countries in view of the expected higher growth rates in economic output. However, their per capita gross domestic product (GDP) and energy consumption will remain much lower than those of the industrialized countries.

6. Meeting the energy requirements of the developing world will require massive investments from national as well as foreign sources, including bilateral and multilateral sources as well as foreign direct investment, and will also require increasing access to international capital markets. Investment will also be required for developing the energy resources of many developing countries, particularly oil and natural gas, for export to the developed market economies, which are becoming more dependent on imported energy.

7. However, initiatives to promote international energy cooperation, especially between oil exporting and oil importing countries, which were quite promising after the Gulf crisis of 1990/91, appear to have stalled. While crude oil prices have declined, taxes on oil products have increased in several developed market economies and a variety of proposals for additional ecological taxes are under consideration. Those developments have led to lower foreign-exchange incomes in several oil exporting developing countries, with adverse effects on their economic growth prospects, political and social stability and ability to invest in additional oil production capacities.

8. Energy consumption in the oil importing developing countries has increased at an annual rate of 5.4 per cent during the period 1970-1991. Of that increase, 63.4 per cent is attributable to oil and natural gas, 28.4 per cent to coal and 8.3 per cent to primary electricity. Indigenous resources provided most of the additional supplies of coal, gas and electric power, while most of the oil requirements continued to be imported. In 1991, oil consumption in those countries was estimated at 8.19 million barrels per day (b/d), while their indigenous production was 1.43 million b/d. Oil imports were thus estimated at 6.7 million b/d for an annual foreign-exchange outlay of approximately US$ 44 billion. Since 1991, indigenous oil production in 17 oil importing developing countries (Bangladesh, Barbados, Benin, Brazil, Chile, Côte d'Ivoire, Cuba, Ghana, Guatemala, India, Jordan, Morocco, Myanmar, Pakistan, the Philippines, Suriname and Thailand) as a group has declined to 1.43 million b/d while consumption has been increasing, with consequent deterioration in the oil trade balance of the oil importing countries.

9. As far as the oil importing developing countries are concerned, the challenge of the future is to accelerate the exploration and development of indigenous energy resources in order to arrest their increasing dependence on imported oil, by exploring for and developing greater capacities for producing indigenous oil, as well as natural gas, coal, hydropower and other new and renewable sources of energy.

I. TRENDS IN ENERGY CONSUMPTION

10. As indicated in the report of the Secretary-General on changing global energy patterns (E/C.13/1994/2, sect. I), world energy consumption since 1970 has grown at an average annual rate of 2.5 per cent. That rate may be expected

to diminish somewhat to 2.2 per cent for the period to the year 2020. In 1970, world energy consumption totalled 4.5 billion tons of oil equivalent (toe); by 1991 it had increased to 7.6 billion toe; by 2020, it may reach 13.8 billion toe.

11. That growth in energy consumption assumes that energy efficiency efforts will continue and even improve in the years ahead. World energy intensity dropped from about 0.56 toe per 1,000 1980 United States dollar of GDP in 1973 to 0.49 toe in 1988 and is expected to drop further to 0.42 toe in 2000 and 0.35 toe in 2020.

12. Increases in energy consumption, especially of fossil fuels, have given rise to environmental concerns at the national, regional and global levels. Air emissions world wide of carbon in the form of carbon dioxide (CO_2) from fossil fuels are expected to increase from 5.6 billion tons in 1990 to 11.3 billion tons in 2020. Large increases are also expected in the emissions of nitrogen and sulphur compounds.

13. Which countries will be the main energy consumers and responsible for emissions? By the year 2020, the developed market economies as a whole will have increased their fossil fuels consumption by 1.04 per cent per annum to 4.7 billion toe; their per capita fossil fuels consumption will reach 4,523 kilograms of oil equivalent (koe). In contrast, in the developing countries, fossil fuels consumption will increase at 4.21 per cent per annum to 6.6 billion toe; their per capita fossil fuels consumption, however, will be very much lower, at 1,003 koe by 2020. For the economies in transition, fossil fuels consumption will increase by 1.23 per cent per annum to 2.5 billion toe; their per capita fossil fuels consumption will remain higher than that of the other groups of countries, at 5,208 koe.

14. Air emissions will follow a similar path. Both energy consumption and emissions are of course related to economic growth. By the year 2020, the developed market economies will account for US$ 38.5 trillion of the global GDP of US$ 56.8 trillion; their per capita GDP will rise to US$ 36,771. The economies in transition will account for US$ 4.8 trillion in total GDP and a per capita GDP of US$ 8,052. The developing world will account for US$ 14.5 trillion in total GDP; their per capita GDP, however, will be only US$ 2,214.

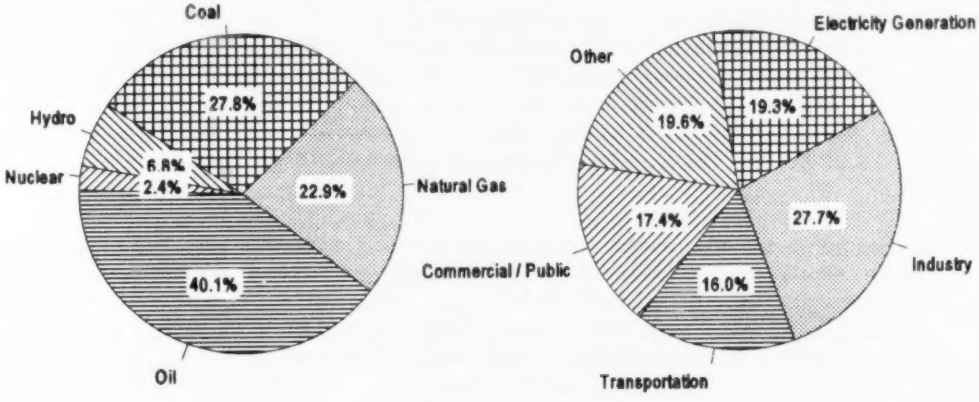
15. The outlook on the trend in energy demand structures, not including traditional non-commercial sources of energy such as fuelwood and biomass, is for major changes in the global energy balance, with an increasing use of natural gas and hydropower and a declining dependency on oil and coal. Natural gas is expected to be the fastest growing component of energy demand, accounting for over 25 per cent of total energy demand by the turn of the century. During that time, coal will remain an important source of energy in a number of countries that are members of the Organisation for Economic Cooperation and Development (OECD) and eastern European countries, the Russian Federation, China and India. Hydropower development will on the whole increase in the developing world, although financial constraints and environmental considerations will have a significant impact on new developments.

16. The rapidly increasing demand from the electric power sector, particularly in developing countries, will underpin the greatly expanded use of natural gas. Consumption for electric power generation is expected to more than quadruple in developing countries by 2005. Environmental considerations will also provide a stimulus for increasing the use of natural gas in other sectors.

17. Similarly, the use of coal to generate electricity will increase. Developing countries are expected to almost double their consumption of coal by 2005. For hydropower, hydroelectricity consumption has more than doubled in many developing countries since 1980. There is a large untapped hydro-potential in many developing countries, but in many of them those resources are increasingly concentrated in more remote areas, where their development is costlier and more difficult. The demand for electricity will remain strong in developing countries to meet the needs of rapid urbanization and industrialization. There is an enormous need to expand the electricity supply grid and for rural electrification.

18. Both global and regional patterns of primary energy consumption have remained practically unchanged since the beginning of the decade. Global shares of primary energy sources and the major purposes for which they were used in 1992 can be seen in figure I. Growth in world total primary energy demand has stalled since 1990, primarily due to declining energy consumption in non-OECD European countries. Developing countries' share of consumption (about 28 per cent) remains slightly more than half that of the OECD countries (53 per cent). 1/

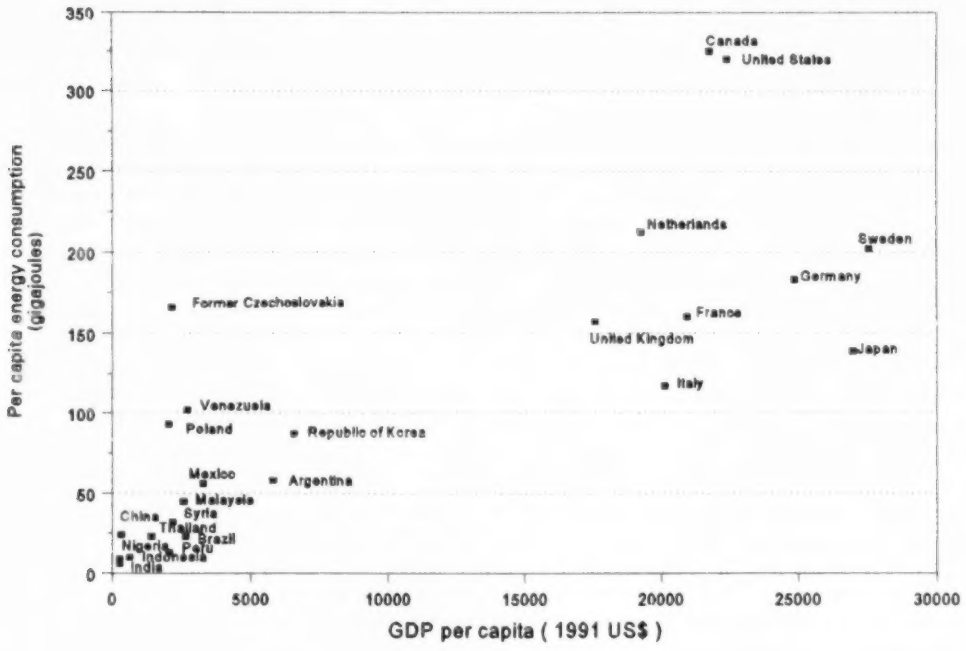
Figure I. Global shares of primary energy sources and the major purposes for which they were used, 1991



Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, based on 1991 Energy Statistics Yearbook, Statistical Papers, Series J, No. 35 (United Nations publication, Sales No. E/F.93.XVII.5).

19. Developments in the level and structure of total primary energy demand in the developing world during the period 1970-1991 have been significant, with many interregional and intraregional variations. The magnitude of those variations depends on the status of the individual countries, such as whether they are net importers or exporters of energy, and on the level of their economic development (see figure II).

Figure II. Commercial energy consumption and GDP, 1991



Source: Same as figure I; and International Financial Statistics (Washington, D.C., International Monetary Fund), September 1993.

II. TRENDS IN ENERGY EXPLORATION, DEVELOPMENT AND PRODUCTION

A. Advances in energy technologies

20. Paradoxically, recent experience indicates that the more energy the world consumes, the more energy reserves are found. The fear of resource exhaustion has been replaced by a state of abundance and oversupply, with obvious consequences for the price of primary commodities, including fossil fuels.

21. The price of crude oil did not rise to US$ 100/barrel as forecast in the early 1980s. It is now barely US$ 15/barrel and it is being argued whether it will stabilize within a $15-20 or $10-15/barrel price range (see figure III).

22. Those developments are generally attributed to two causes: recent advances in energy technologies and the widespread adoption of free market policies.

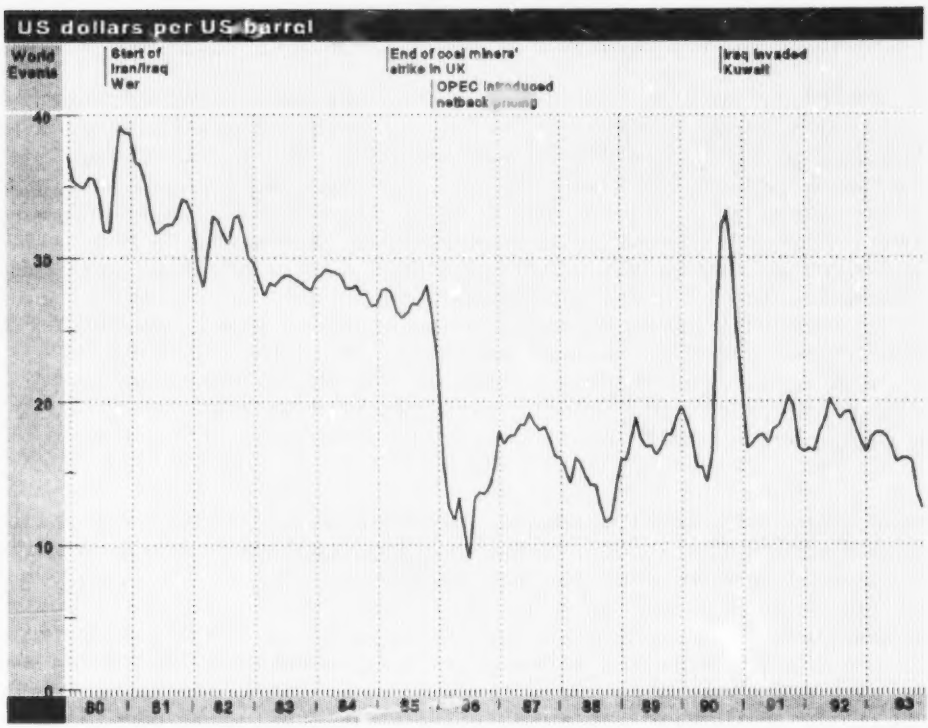
23. The 1970s and 1980s produced an accelerated advance in the earth sciences, largely through the use of computers, and in the innovative interpretation of subsurface data. With the demand for cost-efficient exploration methods brought on by the decline in recent years in the price of oil, many geophysical applications can currently be performed on a personal computer. Rapid advances in colour three-dimensional (3-D) computer graphics based on interactive modelling have forever changed the way geoscientists search for oil and gas and decide where to drill wells.

24. The increasing sophistication and convenience of computer-aided exploration (CAEX) technology has yielded remarkable gains in productivity and quality. Moreover, advances in microcomputer technology has made possible the desk-top workstation, allowing an even broader spectrum of explorers to apply the benefits of interactive interpretation technology to drilling decisions and reservoir development processes. Seismic exploration technology has advanced tremendously and the interpretive benefits of 3-D seismic data have been enormous because of the considerable improvements in subsurface resolution. 3-D seismic data has had an even greater impact on drilling economics, providing far superior information upon which to base drilling decisions.

25. The efficiency and productivity of drilling operations has undoubtedly improved. An important evolution in drilling involves measurement while drilling (MWD), which has largely been responsible for the advances in horizontal drilling. Those advances, as well as advances in computer imaging and seismic analysis of reservoirs, have been vital components of the surge in horizontal drilling. High production rates have been posted with horizontal wells in areas as distant as the northern slope of Alaska, Indonesia, the North Sea and the Gulf of Mexico.

26. Favourable prospects for significant discoveries in deep-water areas have led towards major advances in technology. The petroleum industry now has the technological capability to exploit hydrocarbons beneath several thousand feet of water. It is expected that the next technological step will be to extend the capabilities of deep-water drilling, which currently has a range of 8,000 feet (2,440 metres), to a depth of about 13,000 feet (3,960 metres).

Figure III. Crude oil monthly average prices a/



Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, based on Monthly Commodity Price Bulletin (United Nations Conference on Trade and Development), various issues; and BP Statistical Review of World Energy, June 1993.

a/ Dubai, Brent and Alaska average, spot, F.O.B.

27. After an era in which it was felt necessary to search for oil at any cost in order to ensure supplies, the petroleum industry has now entered a period of systematic research to reduce costs in response to new market conditions, which are increasingly influenced by environmental concerns and legislation aimed at reducing pollution at all levels.

28. Oil industry technology as a whole continues to evolve, driven by steady growth in energy demand, shifts in the energy resource base and mounting concerns about the integrity of the environment. The industry continues its search for breakthroughs on three fronts: (a) georeaction engineering, in which the earth is viewed as a reactor for in situ processes to unlock more hydrocarbon resources; (b) catalytic templating, a new way to manufacture precisely shaped molecules for precise functions in a new fuel or lubricant for the high temperature, high efficiency engines of the future; and (c) technological fulfilment of the environmental covenant, to ensure that future generations not only have an abundance of energy but also have a healthy world in which to use that energy. Each of the three fronts calls for sophisticated analytical and imaging techniques, massively parallel supercomputing, and dynamic, multidimensional simulation at scales from the molecular to the global.

29. Equally important developments in continental and undersea pipelines as well as supertankers and liquefied natural gas (LNG) carriers have narrowed the distances between remote resources and markets.

30. A widespread adoption of free market policies in the oil industries of the former Soviet Union, China and other developing countries, including some countries that are members of the Organization of Petroleum Exporting Countries (OPEC), have opened up vast new areas with considerable oil and gas potential. In fact, in Algeria, Azerbaijan, Kazakhstan and Venezuela, agreements already reached with transnational oil corporations call for the application of modern technologies to oil reservoirs already discovered.

31. As a result of those new technologies and the widespread adoption of free market policies, the adequacy of reserves of fossil fuel for many years to come is assured. At current rates of consumption, oil reserves are adequate for a minimum of 75 years, natural gas reserves for over 100 years and coal reserves for over 200 years.

32. As to NRSE, available projections or scenarios of the future differ widely. They are often based on untested assumptions and optimistic technological forecasts that foresee a rapid reduction in costs which may or may not happen. Moreover, either explicit or implicit assumptions of governmental subsidies and/or massive government-supported research and development programmes are incorporated into such scenarios at a time of world-wide movement towards free market economies and less government involvement in business efforts.

33. The United Nations Solar Energy Group on Environment and Development, in its report entitled "Solar energy: a strategy in support of environment and development" (A/AC.218/1992/5/Rev.1, annex I), estimated that by the year 2020 NRSE would supply about one third of world energy consumption. Under a more optimistic assumption of improved energy efficiency, the contribution of NRSE

would be as high as one half. However, such a rapid development of NRSE would require an array of policy changes and practices by Governments and business, including the full environmental costing of all energy sources.

34. The World Energy Council is much more conservative. The Council projects a gradual increase from the current 18 per cent contribution of NRSE to 21 per cent by the year 2020, on the assumption that current policies are continued. A more rapid increase to 30 per cent would be achieved in its ecologically driven scenario. 2/

B. Crude oil

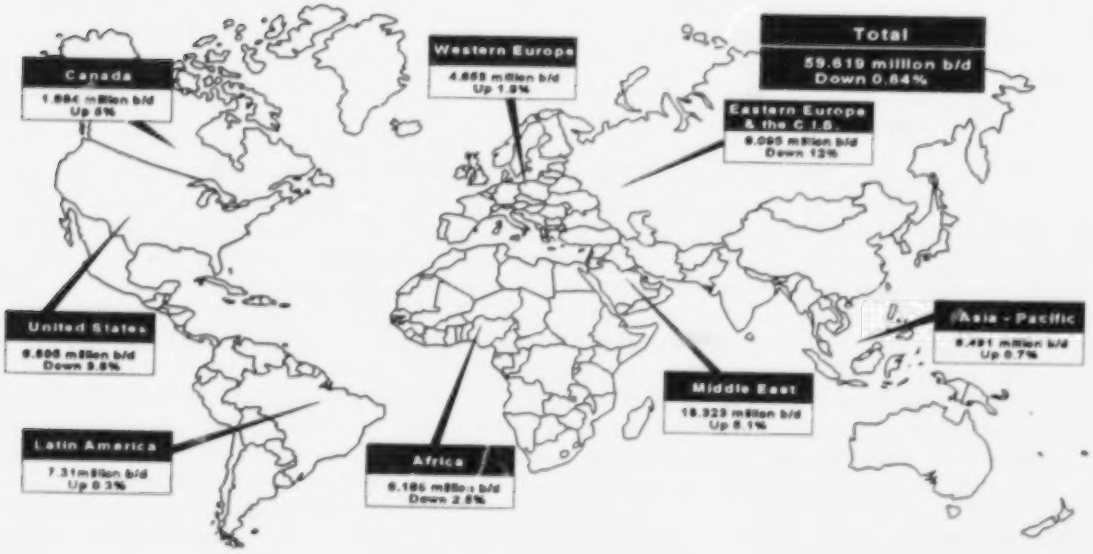
35. World crude oil production, shown in figure IV, illustrates the relative regional production status and the increasing importance of the developing countries in world oil supplies.

36. In 1993, oil production in the former Soviet Union continued on its downward trend; the reduction in output in recent years has been staggering. The year-on-year trend of continuous decline in the United States of America has been offset by increases in production registered in Canada and the North Sea. The member countries of OPEC, especially in the Middle East, and non-OPEC oil exporting developing countries have shown sizeable oil output increases (see figure V).

37. Changes in the estimated world crude oil reserves at the end of 1993 were scattered, with large volumetric gains posted by Saudi Arabia at 861 million barrels, by Venezuela at 680 million barrels, by Malaysia at 600 million barrels, by Brazil at 570 million barrels, by Norway at 478 million barrels, by Ecuador at 414 million barrels and by the United Kingdom of Great Britain and Northern Ireland at 411 million barrels. The largest oil reserves decline - about 937 million barrels - occurred in the United States of America, while reserves fell in Mexico by 373 million barrels, in Pakistan by 209 million barrels and in a number of countries by 200 million barrels or less. None the less, oil producers in the Middle East hold over 65 per cent of the world's total proved oil reserves.

Figure IV. World oil production by region, 1992-1993

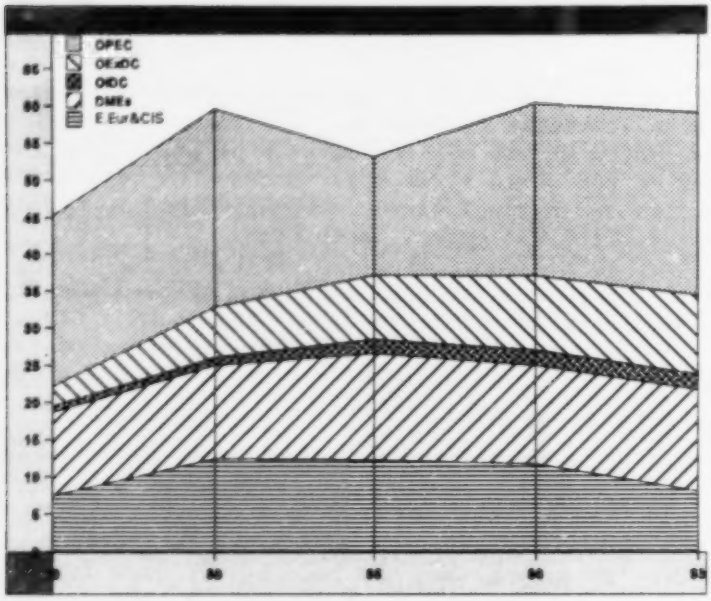
(Percentage change)



Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, based on Oil and Gas Journal, 27 December 1993.

Figure V. Petroleum production by group of countries, 1970-1993

(Millions of barrels per day)



Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, based on Energy Statistics Yearbook (United Nations publication), various issues; and Oil and Gas Journal, 27 December 1993.

Note: OExDC = non-OPEC oil exporting developing countries; OIDC = oil importing developing countries; DMEs = developed market economies.

1. Member countries of OPEC

38. OPEC increased its oil output in 1993 by about 500,000 b/d, following an increase of about 1 million b/d in 1992. The OPEC share of total world oil production now stands at almost 42 per cent, up from 38.8 per cent in 1990, having gained 1.2 per cent in 1993 and 1.5 per cent in 1992. The outlook for OPEC sustainable crude oil production to the end of the century is shown in table 1.

39. Saudi Arabia is now the world's largest producer of oil and has made further progress in its capacity boost to 10 million b/d. Given the size of its oil reserves, estimated at 259 billion barrels of oil at the end of 1993, which is over a quarter of the world's reserves, production capacity for Saudi Arabia is obviously not limited by geological constraints but is merely a function of investments in production and export facilities.

40. The United Arab Emirates (in Abu Dhabi) and the Islamic Republic of Iran have also been building production capacity. Abu Dhabi's capacity is to be raised to 3 million b/d by 1995, and the Islamic Republic of Iran has achieved a capacity of 4 million b/d while announcing a significant discovery in the south that will add 7 billion barrels of light crude to its reserves.

41. Oil production has slipped in a number of OPEC member countries in 1993 compared to 1992. Indonesia's production continued on a declining trend, falling about 7 per cent in 1992 and about 1.8 per cent in 1993. In an effort to encourage activity and stem the downward trend in its production, it has opened more exploration acreage and has made significant improvements in its production sharing terms. Among the African OPEC member countries, Nigeria's production declined marginally to 1.89 million b/d in 1993, after a slight gain in 1992 over the previous year. Algeria's oil output fell significantly to about 750,000 b/d in 1993, while more acreage is being offered to international oil companies. In Venezuela, as part of its new policies involving the private sector a second round of bidding was opened for production rights to old and marginal oilfields, receiving bids from 44 companies for 74 fields, where production might yield 300,000 b/d by the end of the decade.

42. Exploration and development activities in OPEC member countries remain strong (see table 2), with a substantial rise in development drilling during 1990-1992.

Table 1. Outlook for OPEC sustainable crude oil production capacity

(Millions of barrels per day)

	Crude oil production				
		1995		2000	
OPEC countries	End 1992 actual	Almost certain	1992-1995 gain	Attain-able	1995-2000 gain
Middle East					
Islamic Republic of Iran	3.46	4.2	0.74	5	0.8
Iraq	0.43	2.5	-	4	1.5
Kuwait	0.88	2.5	1.62	3.5	1
Saudi Arabia	8.14	10	1.86	12	2
Qatar	0.43	0.45	0.02	0.6	0.15
United Arab Emirates	2.29	2.6	0.31	3.2	0.6
Subtotal	15.63	22.25	4.55	28.3	6.05
Other					
Algeria	0.77	0.8	0.03	1	0.2
Gabon	0.3	0.3	0	0.4	0.1
Indonesia	1.35	1.35	0	1.3	-0.05
Libyan Arab Jamahiriya	1.9	1.8	0.1	2.3	0.5
Nigeria	1.9	2.2	0.3	2.7	0.5
Venezuela	2.31	2.6	0.29	3.5	0.9
Subtotal	8.53	9.05	0.52	11.2	2.15
Total	24.16	31.3	1.24	39.5	8.2

Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, based on Oil and Gas Journal, OPEC Review and Petroleum Intelligence Weekly, various issues.

Table 2. Exploration and development indicators of OPEC member countries, 1983-1992

Year	Licensed area (thousands of km²)	Seismic activity (line-km)	Exploratory drilling (number of wells)	Development drilling (number of wells)
1983	2 565	128 554	474	2 031
1990	3 716	160 078	310	1 178
1991	2 522	222 073	307	1 466
1992	2 528	140 123	308	1 479

Source: World Petroleum Trends 1993.

2. Non-OPEC oil exporting developing countries

43. Oil production from the group of 19 non-OPEC oil exporting developing countries continued to gain, maintaining the upward trend that has prevailed since the 1970s, and its share of total world oil production now stands at 21.4 per cent. Inasmuch as there were serious declines in oil output in half of those countries, a number of new producers have scored big gains in the past two years, offsetting declines in the traditional producing countries.

44. Among the recent entrants to the ranks of oil exporters, Papua New Guinea raised its production to an estimated 125,000 b/d in 1993, after its first crude oil production came on stream in 1992 averaging about 52,000 b/d. Viet Nam's output rose by almost 17 per cent to 123,000 b/d in 1993 as Vietsovpetro boosted flow from offshore Bach Ho field. Exploration in Viet Nam has been active thanks to an aggressive licensing programme and a production level of 400,000 b/d is expected by the year 2000 with the development of another offshore field by a group of Western oil companies.

45. Production increases were reported in 1993 by most of the major players of the group. China posted a production gain of 2.13 per cent averaging about 2.9 million b/d in 1993, although its traditional producing areas were at best holding steady or in decline. China's output stands to gain further: onshore exploration, including the promising Tarim Basin, was opened to foreign oil companies for the first time in 1993 and, also for the first time, bidding was opened for acreage in the East China Sea.

46. In Latin America, non-OPEC oil exporters have made steady gains in their outputs, largely due to work stimulated by the privatization of their oil operations. In 1993, Argentina's production averaged about 575,000 b/d, having gained 3.75 per cent over the previous year. In Peru, the slide in production since the late 1980s was reversed in 1993, with a production of 126,000 b/d, up almost 8 per cent from 1992. There was a notable year-on-year increase in Ecuador: after withdrawing from OPEC in 1992 and thus freeing itself of a

quota, it boosted output by over 6 per cent in 1993, averaging about 341,000 b/d, thanks to the increased exploration and development activities of Petroecuador and foreign contractors. In Colombia, production should grow quickly as the giant Cusiana field comes on stream.

47. In the Middle East, Yemen's oil output continued to gain, increasing by 14.5 per cent to 208,000 b/d in 1993, while reporting more discoveries in the complex Shabwa area. Oman's production also continued on its upward trend, increasing 4.4 per cent for an average of 775,000 b/d in 1993, also reporting a new discovery of light oil in the north-west.

48. In Africa, Egypt posted a production gain of almost 2.5 per cent for about 894,000 b/d in 1993, reporting new discoveries in the Western Desert and the Gulf of Suez. In Angola, after a historic high output of 531,000 b/d in 1992, production slipped 6 per cent in 1993, averaging 498,000 b/d, due to the civil war.

49. Production declines were reported in Malaysia, down 3.18 per cent to about 640,000 b/d in 1993 after an all-time high of 660,000 b/d in 1992 and Mexico, where output declined slightly to 2.66 million b/d in 1993.

50. Exploration and development activities remain strong in the group, with seismic and drilling activities at relatively high levels (see table 3).

Table 3. Exploration and development indicators of non-OPEC oil exporting developing countries, 1983-1992

Year	Licensed area (thousands of km^2)	Seismic activity (line-km)	Exploratory drilling (number of wells) a/	Development drilling (number of wells) a/
1983	1 222	121 461	369 (1 038)	1 310 (3 121)
1990	1 872	191 028	370 (1 697)	750 (5 930)
1991	1 823	150 691	419 (1 705)	846 (5 960)
1992	2 031	172 012	377 (1 719)	717 (6 008)

Source: Same as table 2.

a/ Figures in parentheses denote number of wells in China, which are shown separately to allow a better perspective of the drilling status in other countries.

3. Energy-deficient developing countries

51. The share of total world oil production of the energy-deficient developing countries, which number over 100, has remained stagnant at about 2.4 per cent since the mid-1980s. Of the large number of energy-deficient developing countries, only 18 had any oil production, of whom only Brazil and India registered a sizeable oil output. Among the remaining developing countries that do not have any oil production, fewer than 20 countries have carried out any exploration activities in recent years.

52. Brazil and India account for almost 81 per cent of the total production of the group, about 1.43 million b/d. The state-owned Petroleos Brasileiro SA has continued to make steady gains in its oil production, raising its output by nearly 1 per cent to 631,000 b/d in 1993. The deep-water discoveries in the Campos basin off Rio de Janeiro were being developed and production was rising from those offshore fields, of which Albacora field is to become the largest producer in the country at 60,000 b/d.

53. India's oil production has continued to slide, falling a further 4.2 per cent in 1993 to about 524,000 b/d. Output peaked in 1989 at about 673,000 b/d. New acreage, both onshore and offshore, have been opened for foreign participation in exploration and development. Previous plans to boost production to over 800,000 b/d in fiscal year 1995/96 to offset the ever rising oil import volume have stalled.

54. Of the other producers, Pakistan and Turkey posted significant declines in their outputs in 1993, which fell 16.7 per cent and 7.6 per cent respectively. Thailand's production remained practically unchanged in 1993; a reserves boost at its main onshore field will sustain flow for several more years and oil strikes in the Gulf of Thailand may add to future production.

55. Exploration and development indicators (see table 4) show that such activities during the period 1990-1992 continued at relatively significant levels in those oil producing countries.

56. In the non-oil producing developing countries, exploration activities (see table 5), remained at chronically low levels despite prospects in a large number of sedimentary basins in those countries. Exploratory drilling in 1992 was at its lowest level since the 1980s. However, the sharp drop was largely due to the fact that the vast majority of the well completions reported earlier were drilled in Yemen and Papua New Guinea, which have both since joined the ranks of oil exporters.

Table 4. Exploration and development indicators in oil producing/importing developing countries, 1983-1992

Year	Licensed area (thousands of km^2)	Seismic activity (line-km)	Exploratory drilling (number of wells)	Development drilling (number of wells)
1983	3 077	169 082	823	2 002
1990	4 457	261 608	648	1 627
1991	2 443	277 946	619	1 754
1992	2 485	234 404	605	1 442

Source: Same as table 2.

Table 5. Exploration and development indicators in non-oil producing developing countries, 1983-1992

Year	Licensed area (thousands of km^2)	Seismic activity (line-km)	Exploratory drilling (number of wells)	Development drilling (number of wells)
1983	1 809	50 402	33	0
1990	1 611	21 887	38	2
1991	2 650	18 783	20	0
1992	1 957	24 909	3	0

Source: Same as table 2.

C. Natural gas

57. New additions and increased estimates of existing natural gas reserves continued to outpace production, with world reserves increasing by 14 trillion cubic metres to about 138 trillion cubic metres at the end of 1992. At the current rate of production, the global reserves-to-production ratio stands at nearly 65 years. The reserves-to-production ratio in the Middle East is in excess of 300 years. The most significant reserve additions were in the Middle East and in non-OECD Europe, which continue to hold over 70 per cent of the world's total natural gas reserves (see figure VI).

58. Most of the natural gas is consumed in Europe, the Commonwealth of Independent States (CIS) and North America, where there are significant gas reserves and production. Most of the demand growth has occurred in those regions, as well as in Asia and the Pacific (see figure VII).

59. In Asia and the Pacific, natural gas was the fastest growing fuel, the rate of growth of its consumption in 1992 outpacing that of all other regions. The Republic of Korea registered the highest growth at 30.8 per cent, partly due to the promotion of gas utilization in response to growing environmental concerns at pollution levels in Seoul. The Republic of Korea, having no indigenous natural gas resources, has secured two new LNG base-load contracts with Indonesia and Malaysia and its existing contract with Indonesia has been uprated as well. Double-digit growth rates in natural gas consumption were also recorded in India and Malaysia. India's natural gas consumption grew by 13.5 per cent with the development of infrastructure to deliver gas from the offshore Bombay High field. In Malaysia, the extension of gas pipelines along the Peninsula led to a 17.8 per cent increase in consumption.

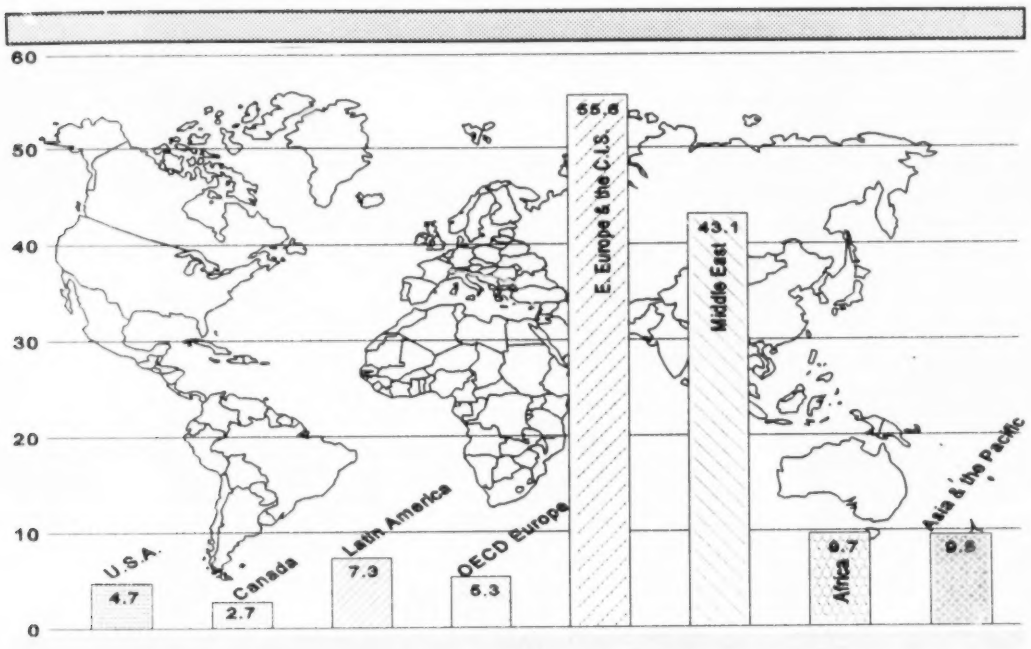
60. In the past decade, the demand for gas in the Pacific Rim countries has more than doubled with annual consumption increasing an average of 8 per cent a year in China, Japan, Taiwan Province of China, South-East Asia, Australia and New Zealand.

61. The sharp growth in demand in the Republic of Korea and Taiwan Province of China has spurred the regional producers, Indonesia, Malaysia and the north-west shelf of Australia to expand their existing capacities. The Pacific Rim accounts for a staggering 70 per cent of all trade in LNG, albeit in a largely regional market. Although the large LNG markets are in Japan, the Republic of Korea and Taiwan Province of China, demand trends throughout the region bear considerable pressure on the overall supply/demand patterns of the region, since LNG plays an increasing role in the fuel diversification strategies of many Asian countries.

62. Natural gas consumption in Brazil increased nearly 10 per cent in 1993, while in Argentina and Venezuela consumption continued to rise by about 5 per cent. Argentina has privatized its national gas utility and recent developments indicate progress in a regional market involving Argentina, Brazil, Bolivia and Chile.

Figure VI. Remaining reserves of natural gas at end-1992

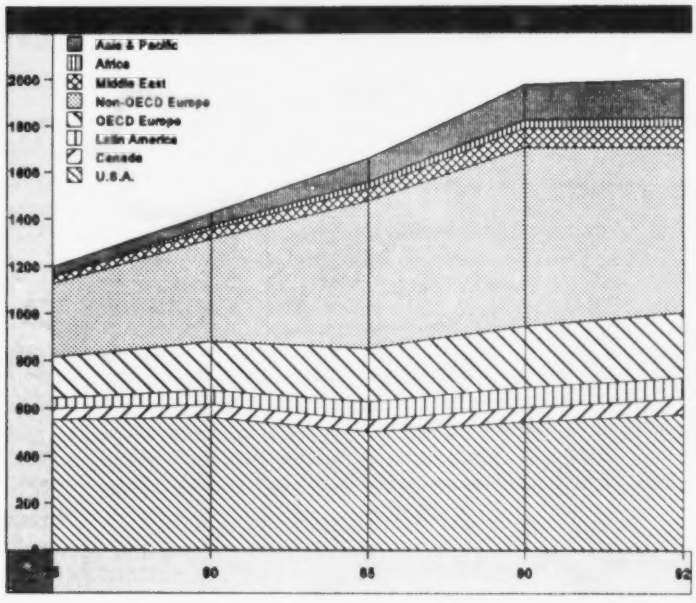
(Trillions of cubic metres)



Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, based on BP Review of World Gas, August 1993.

Figure VII. Natural gas consumption by region, 1975-1992

(Billions of cubic metres per day)



Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, based on the Energy Statistics Yearbook (United Nations publication), various issues and BP Review of World Gas, August 1993.

63. In the Persian Gulf OPEC countries, increased crude oil production, notably in Saudi Arabia, has resulted in increased associated gas production. It has been reported that Qatar has secured an agreement with a Japanese utility to export about 4 million tons per year of LNG from its huge North field, as well as two long-term strategic investment agreements to deliver gas to Italian and other European countries. In the Islamic Republic of Iran, the national gas distribution system is being extended and exports possibilities to Asia and Europe are being studied.

64. Although there are vast amounts of proved natural gas reserves in the Middle East, about 31 per cent of the world's proved reserves, they have been primarily developed for domestic consumption. The main obstacle to gas exports from the region, development costs for which are comparatively low, has been the cost of transportation to the distant, main gas markets in eastern Asia and western Europe.

65. Nigeria's LNG scheme is in a better position to move forward, having secured sales agreements with several European gas companies totalling nearly 6 billion cubic metres a year. In southern Africa, the Pande gasfield in Mozambique, with reserves of over 30 billion cubic metres, stands a better chance of development in view of the recent elections in South Africa: Johannesburg is the only realistic market for the gas from the huge field. 3/

66. The 1,400 km pipeline that will transmit gas from Algeria to Europe via Morocco, the Straits of Gibraltar and the Andalusian region of Spain and onwards to the rest of Europe has been making progress: a contract for the construction of the 530 km Algerian section has been awarded. The completion date for the entire pipeline has been set at 1996.

67. Natural gas, once considered an unwanted by-product of oil production, now provides 22.9 per cent of the world's energy needs. Continued cost-competitiveness and lower air pollutant emissions relative to other fossil fuels, as well as technological developments in its production, transportation and use, will lead to a significant increase in natural gas consumption.

68. In many countries, natural gas has become the preferred fuel in the generation of electric power. Privatization and deregulation policies in the natural gas industries have already led to more open markets and the increasing involvement of a greater number of players, including transnational corporations and gas and electricity companies, in a global effort to enhance the development of that energy resource.

D. Coal

69. The world outlook for coal is one of substantial growth, with production forecast to increase by 25 per cent by the year 2010. 4/ World wide, for the rest of the century most demand growth will be in steaming coal, while the metallurgical market is expected to remain flat.

70. World proved reserves of economically recoverable hard coal are now estimated at 521,413 million tons (see figure VIII) and a further 517,769 million tons of sub-bituminous and lignite are considered to be economically recoverable.

71. In 1992, Asia and the Pacific was the largest regional consumer, accounting for almost 40 per cent of the total world hard coal consumption, followed by North America at 23.2 per cent, non-OECD Europe at 19.2 per cent, OECD Europe at 12.9 per cent, Africa at 3.7 per cent, Latin America at 1 per cent and the Middle East at 0.2 per cent. International trade in anthracite, steam and metallurgical coals was estimated to have remained steady at about 400 million tons per year in the period 1991-1992, about 12 per cent of the total world coal production. Most coal is consumed in the region where it is produced. North America is the main net exporting region and OECD Europe remains the main net importer. Asia and the Pacific region has seen the largest growth in both production and consumption over the past decade (see figure IX).

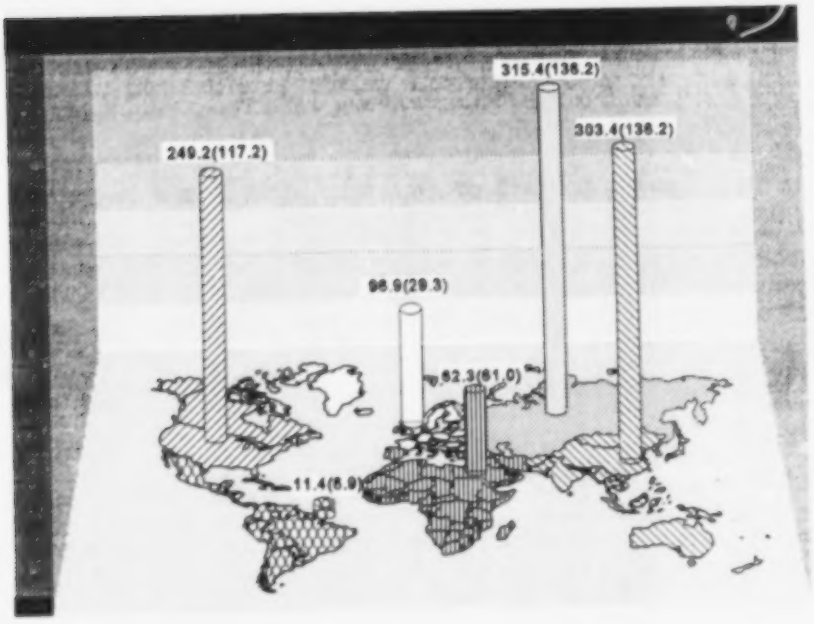
72. Currently more than half the total world coal production is consumed by coal-fired power stations, generating over 40 per cent of the world's electricity. By the year 2000, power station coal consumption is expected to increase to almost 3 billion tons a year, with substantial growth expected in China and India. 5/ In the coking coal sector, the overall downturn in steel production is adversely affecting demand and prices, although steel production is buoyant in the Republic of Korea, Taiwan Province of China, Latin America and the Middle East.

73. Of importance to coal's continuing role as the major world fuel for the generation of electricity are the environment, the pressures of economic development, particularly from the newly industrializing economies of Asia and Latin America, and the need to secure adequate finance to meet the investment required to fuel such development.

74. The future of coal as a major fuel is problematic, mainly because of environmental concerns at the local, regional and global levels over its contribution to local pollution, acid rain and climate change. Energy policies, particularly in the developed economies, often aim at a reduction in coal use through substitution with cleaner fuels such as natural gas. Nevertheless, the magnitude of the reserves in developing countries such as China and India, as well as the cost advantage of coal in electricity generation, in many cases favours the continued growth of coal until more viable energy alternatives can be developed.

Figure VIII. Proved coal reserves a/ at end-1992

(Billions of tons)

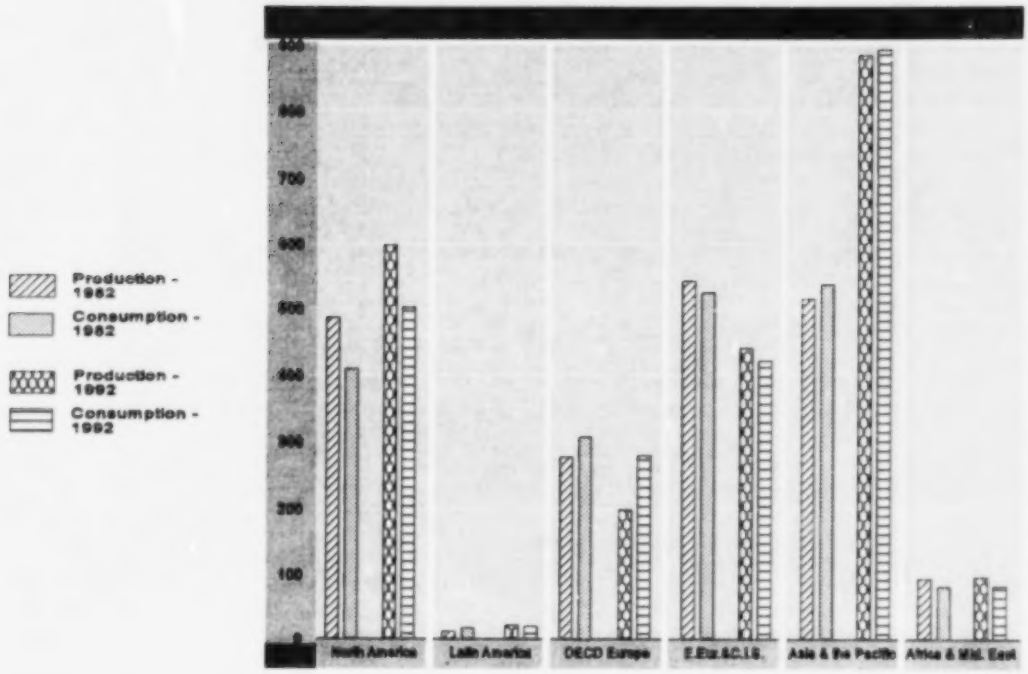


Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, based on the BP Statistical Review of World Energy, June 1993.

a/ Share of anthracite and bituminous coal shown in parentheses.

Figure IX. Coal production and consumption by area, 1982 versus 1992

(Million tons of oil equivalent)



Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, based on the Energy Statistics Yearbook (United Nations publication), various issues and BP Statistical Review of World Energy, June 1993.

E. Electric power

75. Electricity output has been rising rapidly in developing countries in all regions of the world. The fastest growth rate was registered in the Asia and the Pacific region, particularly in the newly industrializing economies. 6/

76. Electric power generation has become the focal point of determined national economic development programmes aimed at accelerating economic growth. Despite impressive growth rates in electricity generation, the per capita electricity consumption of the developing countries remains insignificant compared to that of the OECD countries. The OECD average is 10,000 kWh per head of population (more than 17,000 kWh in Canada and Sweden and over 12,000 kWh in the United States of America), while in the low-income developing countries it is less than 100 kWh.

77. World total installed electric generating capacity stood at 2,485 gW in 1991 and was estimated to have increased to over 2,900 gW in 1992. Of the world total installed electricity generating plants, power plants that use fossil fuels dominate, with a share of about 65 per cent of the total followed by hydro with about 23 per cent and nuclear with 12 per cent.

78. Coal is the leading fossil fuel for electricity generation in the industrial countries and the larger developing countries. In most estimates, natural gas will be the fastest growing non-renewable fuel in electric generation in the 1990s, while coal growth will be limited and oil-fired electricity will decline. In those developing countries with abundant coal resources, for example China and India, coal-fired electricity output will continue to advance rapidly.

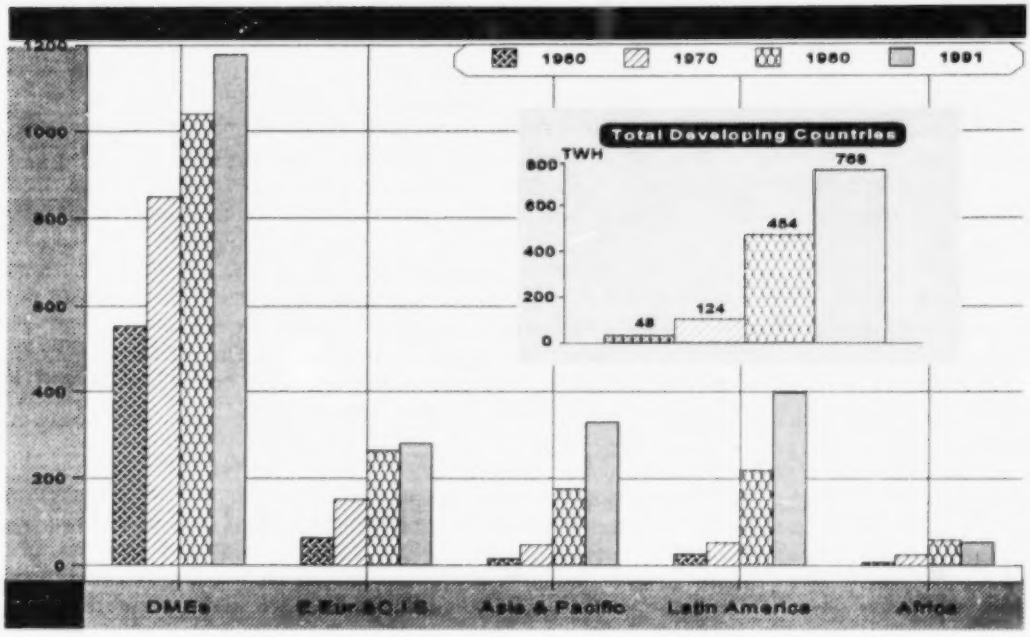
79. Of the renewable sources of energy for electricity generation, hydropower is not only the most reliable but also the most promising source for developing economies. Hydropower continues to gain in Latin America and in Asia and the Pacific. Figure X shows hydroelectricity generation by region. The insert in the chart illustrates the low level of total hydroelectricity generation in all developing countries as compared to that of the developed market economies (about 65 per cent in 1991). However, the hydropower potential of the developing world remains underexploited.

80. Fast-growing electricity needs in the developing countries, with an ever widening gap between energy supply and demand, has prompted several newly industrializing countries to look into expanding the role of nuclear energy in the next couple of decades. The share of electricity generated by nuclear power around the world is shown in figure XI.

81. Nuclear power is clearly gaining importance in the two Asian regional economic powers, China and India, where 12 and 15 new nuclear power plants, respectively, are planned in the next 10 years. The Republic of Korea has plans to construct 27 more nuclear power plants. The Islamic Republic of Iran, Pakistan and the Philippines, in spite of past difficulties in their nuclear power programmes, have not abandoned the deployment of nuclear power. Bangladesh, the Democratic People's Republic of Korea, Indonesia, Malaysia and Thailand have announced their intention to develop nuclear power. In Latin

Figure X. Hydroelectricity generation by region, 1960-1991

(Terawatt hours (tWh))

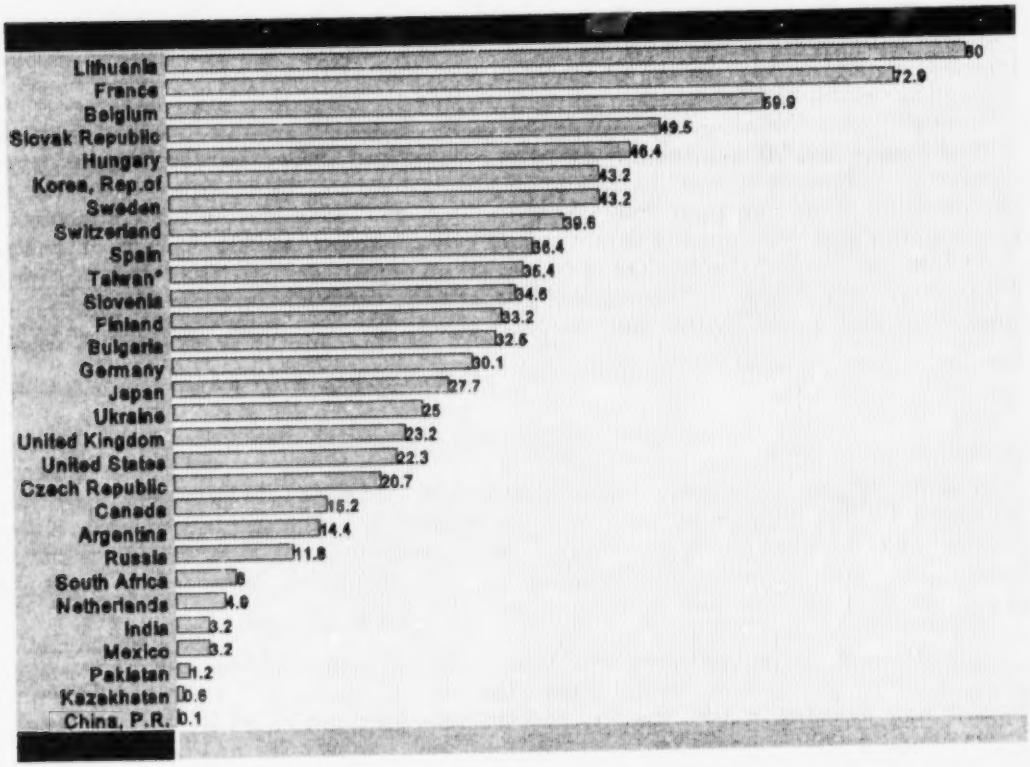


Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, based on Energy Statistics Yearbook (United Nations publication), various issues.

Note: DMEs = developed market economies.

Figure XI. Nuclear share of electricity generation

(Percentage)



Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, based on IAEA Bulletin (1993), vol. 35, No. 3.

* Taiwan Province of China.

America, nuclear power has been developed to a limited extent, with four countries having nuclear power plants in operation or under construction (Argentina (2), Brazil (1), Cuba (2 under construction) and Mexico (1)), which contribute about 2.2 per cent of the region's electricity supply.

82. Almost without exception, dynamic developing economies plan to double their electricity generating capacity between now and the end of the decade, a surge in capacity which is projected to continue well into the next century. To meet that target, most developing countries have embarked on the liberalization and in a few cases the deregulation of their electric power sector and have taken measures to counteract the declines in the financial performance of their public power sectors over the past two decades. It has been recognized that without restructuring and evaluating power sector management on the basis of commercial principles, it is unlikely that the required power sector investment can be mobilized in the 1990s. Developing electricity generating capacity is highly capital-intensive and hydro and nuclear power are the most capital-intensive of all.

III. INVESTMENT TRENDS AND FINANCIAL REQUIREMENTS

83. Recent trends in energy investments and financial requirements were summarized in the report of the Secretary-General on changing global energy patterns (E/C.13/1994/2, sect. III). The present section provides additional information, particularly with regard to oil importing developing countries (for overall lending to developing countries, see table 6).

84. Spending by international oil companies on exploration and development in developing countries apparently continues on an upswing. While comprehensive data are not available for the petroleum industry world wide, the capital expenditures on petroleum exploration and development by majority-owned affiliates of United States companies (see figure XII and table 7) may be indicative of trends during the past decade. Current capital expenditures world wide by those companies, at about US$ 20 billion in 1993, is at the same level it was in 1982. A similar increase can be seen in their spending in the developing countries, although most of the gains have been in Asia and the Pacific region, while in Africa and Latin America expenditures have been much lower.

85. Developing countries seeking oil and gas exploration risk capital must be aware that new and large-scale competition for upstream investment is under way. Changing world political patterns have led to the liberalization of laws regarding foreign investment in the energy sector in almost all countries, resulting in a marked increase in interesting exploration acreage in all geological provinces of the world. It is estimated that exploration acreage available in the 1990s as a result of the opening up process and of the new deep-water technology will amount to twice as much as that of the 1970s.

Table 6. Volume of energy loans by nationality of borrower, 1992 and 1993 a/

(Millions of United States dollars)

Country or area	b/	c/	b/	c/	Country or area	b/	c/	b/	c/
Canada	3 510 291	30	2 698 441	27	Angola	400 000	2	12 000	1
United States	56 688 171	547	54 288 038	412	Cameroon	90 000	2	–	–
North America	**60 198 462**	**577**	**56 986 479**	**439**	Ghana	96 000	1	–	–
Austria	200 000	1	–	–	Liberia	14 000	1	–	–
Cyprus	35 000	1	–	–	Nigeria	–	–	67 358	1
Denmark	25 000	1	–	–	South Africa	–	–	31 153	1
Germany	–		25 000	1	Zimbabwe	–	–	10 890	1
Greece	–		150 000	2	***Africa***	**600 000**	**6**	**121 401**	**4**
Iceland	–		75 000	2	India	512 772	7	1 228 615	15
Ireland	197 500	1	46 875	1	Pakistan	192 000	2	310 500	4
Italy	20 593	1	233 150	2	***India and Pakistan***	**704 772**	**9**	**1 539 115**	**19**
Finland	399 755	5	265 625	5	China	792 000	4	1 208 904	15
Malta	100 000	1	–	–	Hong Kong	258 205	3	2 496 919	5
Netherlands	225 500	4	1 157 740	5	Indonesia	897 638	7	61 523	1
Norway	1 647 523	10	1 377 009	5	Korea, Rep. of	150 000	1	–	–
Portugal	719 552	5	1 610 461	5	Malaysia	1 864 491	10	1 121 206	9
Spain	1 870 023	18	2 097 355	18	Philippines	929 166	16	1 070 376	14
Sweden	300 100	4	852 000	4	Singapore	255 418	3	9 375	2
United Kingdom	8 706 564	48	4 309 875	24	Taiwan d/	417 400	3	–	–
Western Europe	**14 447 110**	**100**	**12 200 090**	**74**	Thailand	1 864 331	22	2 711 298	14
Hungary	33 500	2	–	–	***Southeast Asia***	**7 428 649**	**69**	**8 679 601**	**60**
Russia	–	–	383 053	9	Australia	299 906	2	1 503 752	8
Eastern Europe	**33 500**	**2**	**383 053**	**9**	New Zealand	108 696	1	252 624	2
Argentina	757 700	11	606 000	5	***South Pacific***	**408 602**	**3**	**1 756 376**	**10**
Brazil	310 000	2	625 000	4	Abu Dhabi	–	–	16 998	1
Chile	85 000	1	342 000	3	Algeria	2 029 528	20	726 253	8
Colombia	138 800	5	107 100	2	Iran	314 474	2	–	–
Ecuador	17 700	1	–	–	Jordan	–	–	17 391	1
El Salvador	42 400	2	–	–	Morocco	60 000	1	–	–
Mexico	2 629 172	15	1 822 200	12	Oman	–	–	72 000	3
Venezuela	2 057 200	19	2 460 116	21	Saudi Arabia	3 975 000	5	505 000	2
Latin America	**6 038 972**	**56**	**5 962 416**	**47**	Tunisia	190 000	1	–	–
Belize	–	–	46 000	2	Turkey	91 521	4	389 687	8
Bermuda	–	–	125 000	2	Yemen	–	–	100 000	2
Netherlands Antilles	–	–	1 100 000	2	***Middle East***	**6 660 523**	**33**	**1 937 329**	**26**
Caribbean	–	–	**1 271 000**	**6**	***Developing countries***	**22 703 913**	**173**	**19 510 862**	**162**
Unclassified	**35 000**	**1**	–	–	WORLD TOTAL	**96 555 590**	**856**	**90 836 860**	**694**

Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, based on Petroleum Economist, March 1994.

a/ Signed facilities only.

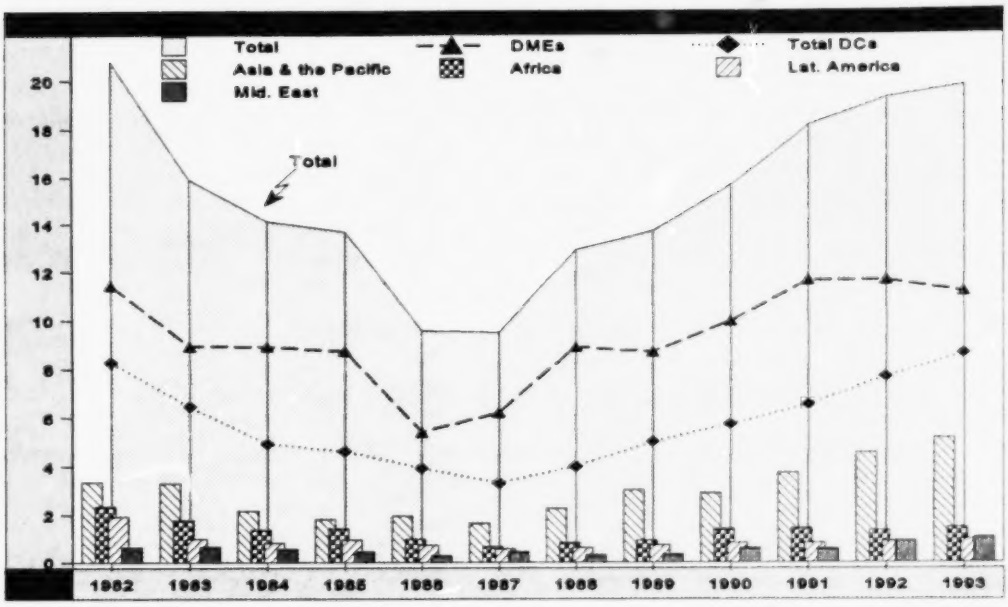
b/ Volume of loans.

c/ Number of loans.

d/ Taiwan Province of China.

Figure XII. Capital expenditures on petroleum by majority-owned affiliates of United States companies, 1982-1993

(Billions of United States dollars)



Source: Department for Policy Coordination and Sustainable Development of the United Nations Secretariat, based on "Capital expenditures by majority-owned affiliates of US companies", in Survey of current business (Washington, D.C., United States Department of Commerce), March 1993.

Note: DMEs = developed market economies; DCs = developing countries.

Table 7. Capital expenditures on petroleum by majority-owned affiliates of United States companies

(Billions of United States dollars)

Region	1982	1984	1986	1988	1990	1992	1993
OECD countries	11.44	8.93	5.4	8.9	9.95	11.63	11.15
Developing countries	8.28	4.36	3.93	4.01	5.72	7.66	8.61
Asia and the Pacific	3.37	2.17	1.94	2.27	2.89	4.56	5.15
Africa	2.35	1.37	0.98	0.82	1.4	1.32	1.46
Latin America	1.92	0.82	0.73	0.62	0.83	0.88	0.96
Middle East	0.64	0.57	0.28	0.3	0.6	0.9	1.04
Total	19.68	13.29	9.33	12.91	15.67	19.29	19.76

Source: Same as figure XII.

86. The international oil companies now have a vastly greater choice of areas for upstream investment than they have had for some time and in fact now face a problem of selecting where to concentrate and be successful. There will be intensified screening towards the very best opportunities. What will that development entail for the developing world, particularly the oil importing developing countries? Since there will be more acreage, more opportunities and the absolute amount of risk capital is not unlimited, it will mean that fewer sums will be available for geologically less promising areas.

87. The difficulty of enticing exploration risk capital into the oil importing developing countries will be more pronounced. Particularly for the non-oil producing oil importing developing countries, financing for oil and gas development will prove harder to come by than at any time in the last 20 years.

88. It may be necessary for those countries to promote fiscal and legal regimes that are substantially more attractive than elsewhere, because of all the non-regulatory constraints, such as poor infrastructure and higher perceived political risk. Governments will have to respond effectively in that competitive environment by offering better terms to attract and keep investments. In a fast-moving environment, Governments will need to constantly monitor and check how their terms compare with those of other countries in both fiscal and operational arrangements. Governments may also have to redefine their roles as regulatory entities and promoters of energy sector development.

89. As for multilateral bank lending, at the Asian Development Bank in 1992, for the second year in succession, the energy sector was the dominant area of lending, accounting for US$ 1,491 million, or 29 per cent of total lending, although that was still below the level in 1991 of US$ 1,560.5 million. Twelve government-guaranteed loans were approved in the sector and one private sector loan of US$ 50 million was disbursed. In addition, 25 technical assistance grants (totalling US$ 11.8 million) were also approved. 7/

90. Energy-related projects approved for World Bank loans and credits in 1993 amounted to US$ 3,586 billion, of which US$ 2,613 billion went to electricity sectors in 15 developing countries, while projects approved in the oil and natural gas sectors went to six countries, amounting to US$ 973 million with US$ 610 million of that going to the Russian Federation. 8/

91. The World Bank recently reported a change in its energy lending policies, particularly in electric power, energy efficiency and conservation, as follows:

> "The World Bank is changing the way it does business in energy according to two policy papers generally endorsed by the executive directors and published in fiscal 1993.
>
> "In future lending, the Bank will redouble its efforts to achieve fundamental institutional requirements in the provision of public power. These will include more transparent regulation and greater openness to private investment and new financial policies. This will also open the way to greater efficiency in the way energy is produced and consumed, thereby integrating environmental considerations into power-sector planning and investment decision.
>
> "Electric power. The Bank and its borrowers cannot keep using a 'business-as-usual' approach to lending when power-utility performance is deteriorating in most developing countries, the policy paper said. Despite the Bank's dialogue with borrowers, overall technical, institutional, and financial performance of power utilities in most developing countries have deteriorated.
>
> "Future Bank lending for power projects will encourage borrowers to restructure their power sectors by requiring 'transparent regulation' of power suppliers. That would leave suppliers free from government interference in the day-to-day operations of power companies. The new regulatory framework could then lead to better economic, financial, environmental, and service policies in the power sector.
>
> "The least-developed countries will receive Bank financing to help improve energy efficiency through imports of power services, including consultants, operating contracts, and equipment. The Bank will try to encourage private investment in power by financing innovative programmes aimed at attracting private investors. Commercialization and corporatization of state-owned power suppliers will also be supported.

"Bank lending for electric power will focus on countries that clearly commit themselves to improving power performance in line with the new principles, the policy paper added.

"Cumulative Bank lending for power, which totalled $45.5 billion at the end of fiscal 1993, supported many state-owned monopoly power utilities in the past because it provided countries with the basic infrastructure needed for production. In recent years, however, the Bank has tried to encourage borrowers to make their power sector more efficient and financially sustainable.

"Energy efficiency and conservation. With reforms in pricing and institutional arrangements, the Bank will be more able to help developing countries improve energy efficiency and conservation.

"The Bank will be more selective about where it lends, however. Support will not continue for energy-supply projects where poorly performing public energy enterprises and governments are unwilling to carry out fundamental structural reforms that could significantly improve the ways they do business. To receive new commitments from the Bank, governments should clearly show they are setting up structural incentives that lead to more efficient energy production and use.

"The Bank will also help improve the way consumers use energy and will assist in identifying, supporting, and promoting demand-side management. Developing countries will also be encouraged to adopt more energy-efficient and less-polluting technologies.

"Many countries are reviewing their energy performance in the face of rapidly growing energy demand, scarce energy funding, and environmental pressures. Rising complaints from customers and a rethinking of the roles of the government and the private sector in energy are adding to this attention.

"A few countries have made gains in energy efficiency, including China, the Republic of Korea, and Malaysia. But many countries still live up to only two thirds to one half of their potential. Simple changes could save countries 20 to 25 per cent of their energy production. With investments in new equipment, others could save as much as 30 to 60 per cent.

"The energy policy paper blamed inefficient energy use on distorted energy-pricing policies, inappropriate control and regulation of energy enterprises, and protection of energy-using industries from competition. Other legal, institutional, and information barriers to efficient market operations were also noted". 9/

IV. CONCLUSIONS AND PROPOSALS FOR ACTION

92. In the report of the Secretary-General on energy exploration and development trends in developing countries (A/47/202-E/1992/51), which was submitted to the General Assembly at its forty-seventh session through the Economic and Social Council, it was pointed out that in its resolution 45/209 the General Assembly had welcomed the outline of a programme of action for the acceleration of energy exploration and development in the developing countries contained in an earlier report on the same subject (A/45/274-E/1990/73 and Corr.1), and had stressed the need to adopt comprehensive national, bilateral and multilateral measures, particularly with regard to financing, investment and technology as well as the training of national technical personnel, in order to accelerate the exploration and development of energy resources in developing countries, including new and renewable sources of energy.

93. As analysed in the present and previous reports of the Secretary-General on the subject, very few of the above objectives, which have been endorsed repeatedly by the General Assembly during the past 14 years, have been achieved, especially in the energy-deficient developing countries.

94. Accordingly, the present report recommends that the Economic and Social Council request the Committee on New and Renewable Sources of Energy and Energy for Development to provide advice and recommendations for further consideration by the international community and the United Nations system, especially with regard to the main elements and objectives of a programme of action.

Notes

1/ All primary energy consumption data and related derivatives in section I are based on the Energy Statistics Yearbook (United Nations publication), various issues.

2/ See World Energy Council, 1992 Survey of Energy Resources (1992).

3/ See Petroleum Economist, May 1993.

4/ See ECOal, quarterly newsletter of the World Coal Institute, vol. 13, September 1993.

5/ See International Energy Agency, Coal Information 1992, Paris, Organisation for Economic Cooperation and Development.

6/ All electricity production and consumption data and related derivatives in section II are based on the Energy Statistics Yearbook (United Nations publication), various issues.

7/ See Asian Development Bank, Asian Development Bank Annual Report 1992 (Manila).

8/ See World Bank, World Bank Annual Report 1993 (Washington, D.C.).

9/ Ibid., p. 49, box 3-4.